

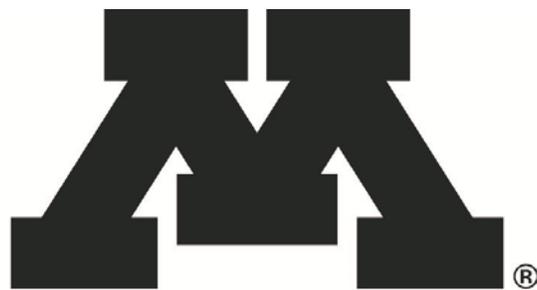
# Minnesota Tree Improvement Cooperative

## 2016 Annual Report

Prepared for the  
April 27, 2017 MTIC Annual Meeting  
At the Cloquet Forestry Center

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<http://mtic.cfans.umn.edu/>



Department of  
**FOREST  
RESOURCES**

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UNIVERSITY OF MINNESOTA

## **MTIC Membership**

### **Full Members**

Beltrami County  
Cass County  
Crow Wing County  
Iron Range Resources and Rehabilitation Board  
Koochiching County  
Minnesota Department of Natural Resources  
Red Lake Nation  
St. Louis County  
University of Minnesota Department of Forest Resources  
UPM Blandin Paper Company

### **Supporting Members**

Bureau of Indian Affairs  
Carlton County  
Clearwater County  
Hedstrom Lumber Company  
Hubbard County  
Lake County

## Executive Summary

The Minnesota Tree Improvement Cooperative (MTIC) completed its 35<sup>th</sup> year in 2016 with 10 full members and 6 supporting members. Dues payments in the amount of \$48,242 were collected, including the contract with the Minnesota Department of Natural Resources. Andrew David directed the MTIC. The Tree Improvement Specialist Position was vacant due to Carrie Pike's departure in November 2015. She moved to Indiana to take the Area Regeneration Specialist position with the USFS Northeastern Area, State & Private Forestry. Jim Warren's last day with MTIC was January 29, 2016, and he is currently a Biological Scientist with the USFS in Indiana.

UMN staff in Grand Rapids filled in to measure white spruce and white pine trials. Egon Humenberger along with students Jared Gottlieb and Mary Kordiak performed field measurements through June 2016, with a portion of Egon's salary being paid from the DNR grant.

Andy held an MTIC Strategic Planning Meeting on February 18, 2016 in Grand Rapids to review needs and direction for the cooperative, and he also held the 2015 MTIC Annual Meeting on June 2, 2016 also in Grand Rapids. As a result of the Strategic Planning Meeting a search committee for the Tree Improvement Specialist position was formed consisting of the following members: Andy David (University of Minnesota), Quintin Legler (Blandin Paper), Mark Pannkuk (St. Louis County), Bryan Pike (Crow Wing County), Deb Pitt (Minnesota DNR), and Danae Schafer (Koochiching County). The search for a candidate was conducted in summer 2016 and the search committee met twice, the first time to review candidates and the second time to interview candidates via Google Hangouts. Julie Hendrickson was hired as the Tree Improvement Specialist and her first day was March 6, 2017.

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## A Letter from the Director

Dear Cooperative Members,

It has been a year of transition, with the departure of Carrie Pike and James Warren the cooperative began a search for the next tree improvement specialist. The search brought us to Julie Hendrickson whose educational background and professional goals make her an excellent fit for the Minnesota Tree Improvement Cooperative. By the time we meet for our annual meeting Julie will have been in the position just under two months. In that time I have been working with her closely and have been impressed with her desire to learn not only what we were doing but why we were doing it. I know she has reached out to Carrie and Jim as needed and they are pleased the cooperative was able to place someone of her caliber in the position.

I know that during the search process I had the opportunity to discuss the role the cooperative plays in various organizations across the state and to hear how MTIC adds value to reforestation programs. Planting improved seedlings is the quickest way to a fully stocked commercially viable forest, decreasing time to free to grow conditions and providing more flexibility with the annual allowable cut. Regardless of whether your interest in improved seedlings is for plantation management, mixed species stands, underplanting as part of a multiple stage silvicultural system or as a hedge against climate change, improved seedlings are a proven part of the regeneration equation.

With Julie on board the cooperative is moving forward, making plans for advanced generation jack pine breeding, evaluation of second generation white spruce crosses, a progeny test of elite red pine lines, and our first white pine progeny test. I look forward to seeing you at the annual meeting or during a summer visit when we can discuss what the cooperative can do to assist your organization with its reforestation and seed orchard management needs. Until then keep in mind that progressive organizations plant improved seedlings.

Sincerely,

*Andy*

Andrew David

Director, Minnesota Tree Improvement Cooperative

## **Introduction**

The Minnesota Tree Improvement Cooperative (MTIC) completed its 35<sup>th</sup> year of operation in 2016. This report summarizes activities and accomplishments from January 1 to December 31, 2016 and reports finances for the 2016 fiscal year from July 1, 2015 to June 30, 2016. It is organized into five major sections: Administration, Finances, Seed Orchards, Species Reports, and the Appendix.

## **Administration**

MTIC staffing was much reduced in 2016. Longtime employees Carrie Pike and Jim Warren left MTIC prior to February 2016 for new positions with the US Forest Service in Indiana. Egon Humenberger, UMN Forest Resources staff based in Grand Rapids, and students Jared Gottlieb and Mary Kordiak conducted field work for MTIC through June 2016. Mr. Humenberger retired in October and has since moved to Austria. Andy David serves as the Director of MTIC and also as the Interim Director of Operations for the Cloquet Forestry Center (CFC,) dividing his time among Grand Rapids, Cloquet, and St. Paul.

The Tree Improvement Specialist position was vacant for all of 2016, and Julie Hendrickson was hired to fill it on March 6, 2017. She wrote this report with input from Andy David and MTIC cooperators.

The advisory committee, consisting of representatives from each member organization, formally met twice. The first meeting was the MTIC Strategic Planning Meeting on February 18, 2016 at the North Central Research and Outreach Center (NCROC) in Grand Rapids and the second meeting was the 2015 Annual Meeting on June 2, 2016, again at NCROC. Both meetings were led by Andy David.

## Seed Orchards

The MTIC maintains approximately 59 active conifer seed orchards covering about 132 acres (**Table 5**). These numbers were taken from the 2015 Annual Report and will be reviewed this summer for accuracy.

The MN DNR's General Andrews Nursery facility in Willow River is currently being used as both a tree improvement center and a fire training facility. A 1<sup>st</sup> generation clonal white spruce orchard was established there in 2012, rootstock has been planted for field grafting of jack pine and red pine, and several fields have been reserved for future trials and orchards (tentatively red pine, white pine, jack pine, black spruce, white spruce, and oak.)

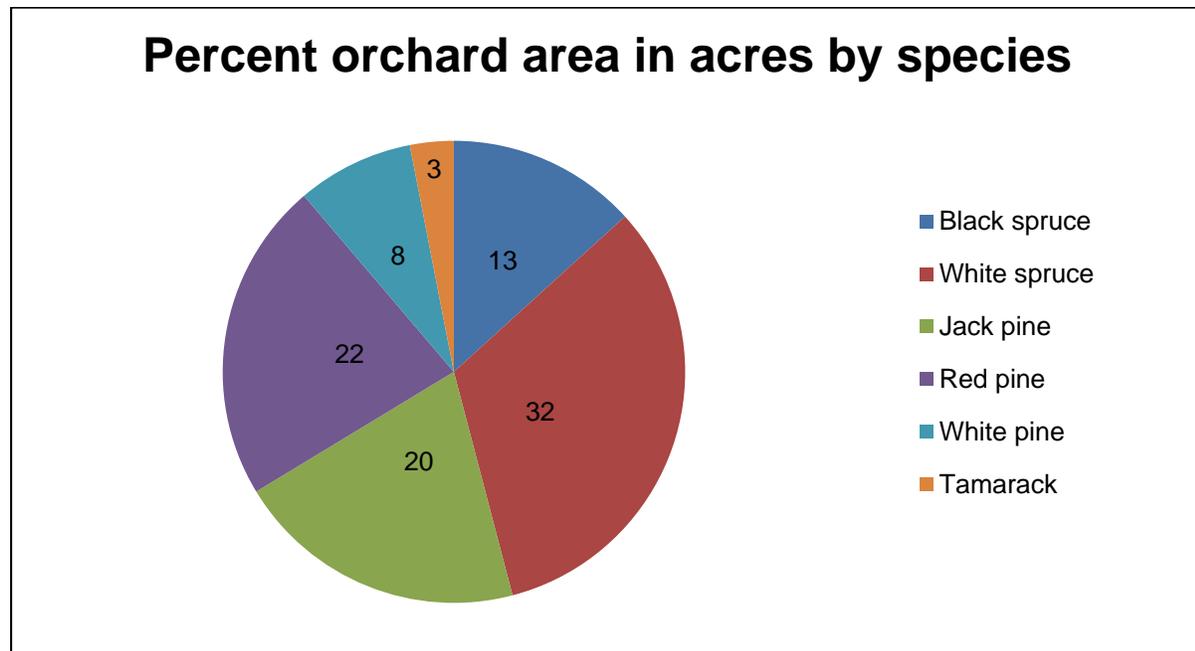
July 2016 wind storms impacted accessibility to St. Louis County's Ellsburg Road orchard for a few days and blew down a handful of the 1<sup>st</sup> generation jack pine. No

cones were collected from the orchard complex in 2016 but fence posts were replaced, downed trees were removed, and grafted white pines were planted.

**Figure 1** shows the percent of orchard acreage that each species occupies in the MTIC program. The current status of all *Picea* orchards is shown in **Table 6**. Current *Pinus* and *Larix* orchards are shown in **Table 7**. All 'active' research trials related directly to the MTIC are shown in **Table 8**.

**Table 5.** Seed orchard acreage by species and orchard type.

<i>Orchard Type</i>	<i>Black spruce</i>	<i>White spruce</i>	<i>Jack pine</i>	<i>Red pine</i>	<i>White pine</i>	<i>Tamarack</i>	<i>Total acreage</i>
First Generation Clonal	8	16	1	---	11	---	<b>35</b>
First Generation Seedling Seed	5	---	19	26	---	4	<b>63</b>
Improved First Generation Clonal	---	15	---	3	---	---	<b>13</b>
Second Generation Full Sib	4	11	6	---	---	---	<b>21</b>
<b><i>Total acreage by species</i></b>	<b>17</b>	<b>42</b>	<b>26</b>	<b>29</b>	<b>11</b>	<b>4</b>	<b>132</b>



**Figure 1.** Species composition (percentage of total acres) of orchards and seed production areas in the MTIC.

**Table 6.** *Picea* spp seed orchards actively managed by the MTIC.

<b>Species</b>	<b>Orchard Type</b>	<b>Organization</b>	<b>Planting</b>	<b>Date Planted</b>	<b>Size (ac)</b>	<b>Live Trees</b>
Black spruce	1st Gen. Seedling	Minnesota DNR	Eaglehead	5/17/1978	2.7	487
		UPM-Blandin	Blackberry	5/22/1978	2.5	596
		U of M CFC	Plantation "U"	5/22/1978	2.5	3,168
	1st Gen. Clonal	U of M CFC	Airport 40	5/1/1995	1.1	238
	Improved 1st Gen. Clonal	Koochiching County	Big Falls	5/19/1989	2.3	79
		Koochiching County	Ditch 7	5/27/1998	4.0	50
		Minnesota DNR	Sturgeon Lake	5/1/1979	1.3	812
Minnesota DNR		Split Rock	5/27/1992	2.4	262	
<b>Totals:</b>				<b>8 Orchards</b>	<b>19</b>	<b>5,692</b>
White spruce	1st Gen. Clonal	Lake County	Two Harbors	9/2/1987	1.0	183
		Minnesota DNR	Cotton	5/1/1977	12.0	206
		Minnesota DNR	E3	5/12/2012	2.5	172
		Minnesota DNR	E4	5/12/2012	2.8	192
		St. Louis County	Ellsburg Rd.	5/11/1988	1.5	189
		UPM-Blandin	Arbo	5/1/1976	1.5	121
	1-1/2 Gen. Clonal	Carlton County	Gillogly Road	4/1/2003	2.1	122
		Minnesota DNR	Split Rock	9/2/2001	3.7	209
		Red Lake	Redby	4/1/2004	0.9	125
		UPM-Blandin	College	9/5/2000	2.9	762
	2nd Gen. Seedling	Lake County	Ostman Pit Road	6/6/2005	1.3	804
		Itasca County	Wabana Lake	5/20/2003	1.8	689
		Minnesota DNR	Eaglehead	6/3/2003	1.8	396
		Minnesota DNR	Eaglehead	5/1/2005	1.3	398
		St. Louis County	Ellsburg Rd. East	6/6/2003	2.1	368
		UPM-Blandin	Feeley	5/1/2005	2.4	1,530
<b>Totals:</b>				<b>16 Orchards</b>	<b>42</b>	<b>6,466</b>

**Table 7.** *Pinus* spp and *Larix laricina* orchards actively managed by the MTIC.

<b>Species</b>	<b>Orchard Type</b>	<b>Organization</b>	<b>Planting</b>	<b>Date Planted</b>	<b>Size (ac)</b>	<b>Live Trees</b>
Jack pine	1st Gen. Seedling	Carlton County	Gillogly Rd.	28-Jun-83	5.5	183
		Crow Wing County	Crow Wing	04-Jun-85	2.1	247
		Iron Range Resources	Calumet	16-Sep-82	1.7	220
		Minnesota DNR	Longprairie	18-May-84	4.0	465
		Minnesota DNR	Nickerson	15-May-84	2.4	387
		Red Lake Nation	Redby	29-Apr-87	1.8	516
		St. Louis County	Ellsburg Rd.	10-May-88	1.6	279
	2nd Gen. Seedling	Crow Wing Co. / MN DNR	County Line	01-May-99	2.6	526
		St. Louis / Iron Range Resources	Ellsburg Rd. East	12-May-99	3.8	895
<b>Totals: 9 Orchards</b>					<b>25.5</b>	<b>3,718</b>
White pine	1st Gen. Clonal	Minnesota DNR	Split Rock	25-May-93	1.0	88
		Minnesota DNR	St. Francis	15-May-85	3.0	319
		Red Lake Nation	Cooks Rd.	05-May-11	2.2	193
		St. Louis County	Ellsburg Rd.	02-May-90	1.1	233
		St. Louis County	Ellsburg Rd. East	21-Jun-99	2.5	183
<b>Totals: 5 Orchards</b>					<b>9.8</b>	<b>1,016</b>
Red pine	1st Gen. Seedling	Carlton County	Gillogly Rd.	10-Jul-81	6.6	38
		Cass / Beltrami/ Hubbard Counties	Blind Lake	10-Sep-91	5.3	400
		Minnesota DNR	Cotton	29-Jul-81	4.5	462
		Minnesota DNR	Eaglehead	25-Jun-81	3.6	128
		St. Louis County	Ellsburg Rd.	09-May-88	5.5	473
	1st Gen. Clonal	Carlton County	Gillogly Rd.	01-May-11	0.5	51
		Red Lake Nation	Cooks Rd.	05-May-11	1.3	50
		St. Louis County	Ellsburg Rd. West	01-Jun-11	1.5	84
	<b>Totals: 8 Orchards</b>					<b>28.8</b>
Tamarack	1st Gen. Seedling	Minnesota DNR	Split Rock	12-May-08	4.3	1,795
<b>Totals: 1 Orchard</b>					<b>4.3</b>	<b>1,795</b>

**Table 8. Active MTIC research trials.**

<i>Species</i>	<i>Planting Type</i>	<i>Year planted</i>	<i>Organization</i>	<i>Planting Name</i>	<i>Last measured</i>	<i>Next Scheduled</i>
Black spruce	Full-sib progeny test	1995	U of M	CFC-Airport 40	1995	--
	Comparison trial	2008	Koochiching County	Manitou	2012	2017
White spruce	Comparison trial	1993	Minnesota DNR	Dago Lake Rd	2012	2022
		1993	Potlatch Forest Holdings, Inc.	Orr	2012	2022
		1993	Plum Creek Timber Company	Gordon	2012	2022
		1993	Blandin Paper Company	Hwy 61	2012	2022
		1995	U of M	CFC-Airport 40	2005	2017
		2003	Koochiching County	Little Fork	2012	2022
		2003	Minnesota DNR	Side Lake *	2012	2022
		2003	Potlatch Forest Holdings, Inc.	Brookston	2012	2022
		2003	St Louis County	Jean Duluth Rd	2012	2022
		2003	UPM-Blandin	Wilson Lake *	2012	2022
	Progeny test	1986	Lake County	Finland	2015	2025
		1986	Minnesota DNR	Nickerson	2015	2025
		1986	Minnesota DNR	Ross Lake	2015	2025
		1986	St Louis County	Rabbit Lake	2005	2017(?)
		1986	UPM-Blandin	Nine-mile	2015	2025
	2nd generation population	2003	Itasca County	Wabana Lake	2012	2017
		2003	St. Louis County	Ellsburg East	2012	2017
		2003	Minnesota DNR	Eaglehead	2012	2017
		2005	Lake County	Ostman Pit	2014	2019
		2005	Minnesota DNR	Eaglehead	2014	2019
2005		UPM-Blandin	Feeley	2014	2019	
Jack pine	2nd generation population	1999	St Louis / IRRRB	Ellsburg East	2008	--
		1999	Crow Wing / MN DNR	County Line Rd	2008	--
Red pine	Comparison trial	2007	Beltrami County	Lake Bemidji	2011	2017
		2007	Potlatch Forest Holdings, Inc.	Lake George	2011	2017
		2007	U of M	CFC	2011	2017
		2007	St Louis County	NE Grade	2011	2017
White pine	Progeny test for blister rust resistance	1999	St Louis County	Ellsburg Rd	2008	--
		1999	USFS	Grand Marais	2008	--
		1999	ORSO	ORSO	2008	--

### Cone Collections

In 2016, for the first time Blandin Paper had their seed extracted and stored at the Badoura state nursery. Previously they had their seed extracted by C. Williams of Cass, MN and stored it in their own freezer.

The Forest Genetics laboratory in Grand Rapids sustained two flooding incidents in early 2017 due to frozen sprinkler system pipes. MTIC had ampules of pollen and seed stored there, including seed from red pine crosses made for the 2<sup>nd</sup> generation population trial, and jack pine and white pine pollen for advanced generation breeding. An initial inventory indicated that no seed was lost and pollen losses were restricted to aspen species. A final inventory of remaining pollen and seed will be made once the Forest Genetics laboratory is functional and will be necessary before plans can be made for advancing red pine, white pine, and jack pine.

113.7 bushels of cones were collected in MTIC orchards in 2016, as summarized in **Table 9**.

**Table 9.** Cones collected by MTIC members in 2016.

<i>Species</i>	<i>Agency</i>	<i>Orchard</i>	<i># bushels</i>
Black spruce	UPM Blandin	Blackberry	10
	MN DNR	Split Rock	25
White spruce	UPM Blandin	College	25
	MN DNR	E3 and E4	0.8
	MN DNR	Split Rock	4.6
	Carlton County	Gillogly Road	3
	Red Lake	Redby	0.5
Jack pine	Crow Wing County	Crow Wing Co/MN DNR 2 <sup>nd</sup> Gen Seedling	7.5
	MN DNR	E2	0.3
	Carlton County	Gillogly Road	5
<i>Total bushels collected:</i>			113.7

## Species Reports

### Black spruce

According to reports from MTIC cooperators, black spruce cone crops were moderate in 2016. Cones were collected at Blandin's **Blackberry** and MN DNR's **Split Rock** orchards.

### White spruce

White spruce cone crops were moderate, and trees were topped at Blandin's **College** orchard resulting in 25 bushels of cones collected. Cones were also collected at MN DNR's **Split Rock** orchard and **E3/E4** blocks and at Red Lake's **Redby** orchard.

Topping trees in 2015 led to a bumper crop of cones in 2016, and Carlton County picked each and every white spruce cone at their **Gillogly Road** orchard with the hope of curtailing cone insects.

Thirty year measurements of the white spruce progeny tests at **Finland, Ross Lake**, and **Nine Mile** were completed in spring 2016 by Egon Humenberger, Jared Gottlieb, Mary Kordiak, and MTIC cooperators. The data has been entered into electronic form but has not yet been analyzed. Of particular interest will be the analysis of genotype x environment interaction. Over the course of this progeny test analysis has shown a small but non-significant increase in GxE with time. If the next analysis indicates a significant GxE effect the data could be used to make additional removals from existing seed orchards depending on the genotypes involved and the locations where they would be deployed.

### Jack pine

Jack pine seed can be in heavy demand depending on regeneration efforts and the average age of jack pine stands on cooperator lands. As a result cooperators have been looking to increase orchard capacity in recent years or find a way to increase seed production from older orchards. In 2015, jack pine rootstock was planted in General Andrews block **E5** for an improved 2<sup>nd</sup> generation clonal orchard. The intention is that

this rootstock will be field grafted with scion from selected individuals from the 2<sup>nd</sup> generation Crow Wing County/MN DNR **County Line** orchard.

MN DNR collected 0.3 bushels of jack pine cones at the St. Croix woods run jack pine seed production area in block **E2** at General Andrews, in spite of many forest health issues found in this block—Zimmerman pine moth, pine shoot moth, scales, sooty mold, and galls.

Carlton County had an abundance of jack pine cones at their **Gillogly Road** orchard. They were able to pick enough to meet their regeneration goals plus sell excess to the MN DNR. Crow Wing County picked jack pine cones from topped trees and squirrel stashes from the **County Line** orchard that they share with MN DNR.

### **Red pine**

Red pine remains Minnesota's highest planted species and represents about one-fifth of the Cooperative's seed orchard capacity. Since red pine produce cones at the ends of branches throughout the crown as opposed to primarily at the top as the orchard trees have aged and increased in size it has become more difficult to obtain adequate seed for regeneration efforts. As a result of these issues and sporadic seed production, individual cooperators have been looking for ways to improve access to seed while retaining improved qualities. Many are considering newer, smaller, orchards to replace their older, larger orchards.

In 2015, MN DNR planted red pine rootstock at General Andrews in block **E1** for an improved 1<sup>st</sup> generation clonal orchard. The intention is that this rootstock will be field grafted with scion from selected individuals from 1<sup>st</sup> generation seedling orchards at **Eaglehead, Ellsburg Road, and/or Cotton**.

### **Tamarack**

The tamarack program is relatively small as there is only one cooperator (MN DNR) with an orchard and their desire was to provide a steady supply of seed, not necessarily improved seed. As a result the seed orchard at **Split Rock** is a rolling block orchard of roughly 4 acres. On an annual basis the DNR assesses need for tamarack

seed and harvests enough trees with intact cones to meet this need. Ideally, as acres are removed additional seedlings are planted on the site to replace trees harvested.

This rolling block system has served the seed supply needs of DNR and works exceptionally well when the targeted species is planted on the correct site, as is the case for the tamarack at **Split Rock**.

### **White pine**

MN DNR potted white pine rootstock in preparation for grafting of blister rust-resistant genotypes in spring of 2017.

St. Louis County planted 59 grafted white pines in the NE section of their **Ellsburg Road** orchard. These trees were grafted at the US Forest Service's Oconto River Seed Orchard and were planted in gaps left by previously unsuccessful grafted trees.

## White Pine Activities 2016

### Disease Garden Trial

In 2012 we planted an eastern white pine disease garden trial to evaluate whether or not progeny of selected parental genotypes were more resistant than their parents. This experiment was replicated on three sites, Eveleth DNR, Ely at Hubachek Wilderness Research Center (HWRC) and north of Duluth on private land the Namebini estate. In early summer 2016 we visited Eveleth and Ely for site maintenance and again later in the season to measure survival and height of seedlings and grafts and to look for evidence of white pine blister rust.

As of May 2016 there is no evidence of white pine blister rust at Eveleth while 2.7% of the seedlings are infected at the HWRC site. Survival of seedlings after five growing seasons is excellent with over 95% of seedlings surviving at both sites. Seedling height is very similar at the two sites with the average height among Eveleth seedlings at 104.6 cm and at HWRC 101.2 cm.

At Eveleth 15 trees died between ages three and five. Six of these dead 15 were grafts of a single genotype, Tofte #305, which was not infected in 2010 after 35 years in a high rust risk area near Tofte, Minnesota. Two seedlings of H-109 x H-111 (both susceptible parents) from different replications died and the other seven seedlings that perished were all of different genetic backgrounds. There was no evidence of white pine blister rust among any of the 15 seedlings that died, however there is blister rust in the area as an earlier white pine planting in the same locale has numerous examples of infected saplings.

By contrast the HWRC site near Ely, Minnesota definitely has blister rust actively working in the trial as 2.7% of all seedlings are infected. Two seedlings have died of blister rust since year three measurements and nine others continue to live with the disease. The incidence of blister rust is well spread through the plantation with infected seedlings in all three replications. The 11 infected seedlings represent nine different seedlots with P30 x H111 (resistant x susceptible) and ON469 x o.p. (resistant x open pollinated) each having two infected seedlings in different replications.

The Eveleth and Ely sites are well matched for seedling survival and growth and should allow for good comparisons of field resistance to white pine blister rust among the different seedlots. The Namebini estate site was planted one year later than Eveleth or Ely and will be measured at the end of the 2017 growing season. Survival at the end of two years was excellent at over 98%. Survival at all three sites is excellent and blister rust is either present in the trial already (Ely – HWRC), nearby in a different trial (Eveleth – DNR) or present as the result of a high rust risk area (Duluth – Namebini). These sites should be monitored regularly (1-2 year intervals) for the incidence of blister rust to maximize the value of the information on resistance or susceptibility.

### **White Pine Breeding**

Unlike some other conifer species whose southernmost range approximates central to northern Minnesota the range of eastern white pine extends from the northern provinces of Canada down to the Carolinas, Tennessee and northern Georgia. It is our one native conifer that is predicted to be a warmer climate winner not only because of its more southerly range but also because it appears to have a fairly stable phenology across regions.

Historically, the MTIC white pine program has been a search for increased disease resistance and has never utilized a progeny test to evaluate common traits such as height, diameter, or stem form. As promising individuals come out of research undertaken by the MTIC and the Forest Service's Oconto River Seed Orchard there is an opportunity to progeny test for improved disease resistance but also improved growth and stem form by field testing crosses among parents with improved resistance.

In 2014 we started making controlled crosses among better parents in our disease breeding program with an eye towards creating enough seed in each family to provide seedlings both for progeny tests and advance generation blister rust screening. These crosses among higher blister rust resistant parents could be combined with controlled and open pollinated seed collections from other individuals selected for growth and form in our member programs.

Most of the controlled crosses in 2014 were made in the St Louis County seed orchard due to location and graft size. In the summer of 2014 we lost about 20-30% of the crosses to high winds which snapped branches with pollination bags and had to remake these crosses in 2015. In the summer of 2016 ten of the twelve remade crosses were lost to cone collectors, damage by mowers or an unknown reason resulting in just two successful crosses (**Table 10**).

**Table 10.** White pine controlled crosses made in 2015 and the number of successful cones and seed extracted and collected from each.

Female	Male	# Cones	Date Pollinated	Comments	Viable Cones	Seed Collected
C-137	P-343	12	19 June 2015	Branch pruned		
C-157	P-327	20	19 June 2015	Cones collected	16	1250
MI-2	MI-27	12	23 June 2015	Lost reason unknown		
MI-4	MI-27	20	19 June 2015	Branch pruned		
MI-4	MI-112	12	19 June 2015	Branch pruned		
MI-4	MI-117	11	19 June 2015	Branch pruned		
MI-29	C-101	20	23 June 2015	Lost reason unknown		
S-504	C-101	35	19 June 2015	Cones collected	2	105
C-170	MI-27	6	19 June 2015	Branch pruned		
C-170	C-101	6	19 June 2015	Branch pruned		
S-512	2410	25	23 June 2015	Branch ripped off by mower		
S-517	2410	20	19 June 2015	Branch pruned		

Because remaking these crosses would require an additional two years until new seed could be collected (pollinate 2017 – collect seed fall 2018) it would be expeditious to move forward with planning for the trial instead of waiting to remake the crosses. Progeny testing white pine seems like a daunting task because the species is a favorite winter forage food for white tailed deer. Bud capping is the traditional anti-browsing protection method for white pine seedlings but it must be repeated each season until the seedling terminal buds have grown beyond the reach of deer standing on their back legs. This can be expensive to pay crews for capping as well as administer the bud capping grants. We have successfully protected white pine seedlings in genetic trials at several locations with high deer densities (Eveleth DNR office, HWRC in Ely, Wolf Ridge Road outside Grand Marais and the Namebini estate north of Duluth) by erecting a fence using steel U-posts and five foot high woven wire fencing (**Figure 2**). Corners

can be reinforced with pressure treated 4x4s. As long as the trial does not bisect a deer path and there is additional food outside the fence it appears that we can protect seedlings from deer browse for the life of the fence, about 10-15 years.



**Figure 2.** Simple fence of U-posts and five foot tall woven wire fencing used successfully to exclude white tailed deer and protect white pine seedlings from browse for about 10-15 years.

## 2017 Cooperative Work Plan

- visit all cooperators
- take final inventory of MTIC seed and pollen in Grand Rapids
- write MTIC 35 year report

### **Black spruce**

- Measure comparison trial (Koochiching County)

### **White spruce**

- Measure comparison trial (CFC) if still intact
- Measure 2<sup>nd</sup> generation populations (3 sites)
- Analyze 30 year progeny test data, make management recommendations

### **Jack pine**

- Review plans for field grafting at General Andrews; rootstock size, selections
- Plan for advanced jack pine breeding program

### **Red pine**

- Review plans for field grafting at General Andrews; rootstock size, selections
- Inventory seed from controlled crosses
- Plan for red pine progeny test of elite lines
- Measure comparison trials (4 sites) and analyze data

### **White pine**

- Plan for progeny tests
- Plant rust resistant trees that were grafted in spring 2017 (General Andrews)
- Inventory seed from controlled crosses, review need for additional crosses
- Visit Disease Garden Trials, measure Namebini site

### **Hemlock**

- Review plans for field grafting at Carlton County; rootstock health and size, potential source of scion material

### **Tamarack**

- Monitor seed orchard for insects and make cone collection recommendations

## Appendix 1 - MTIC History

**1981** – Carl Mohn, Forest Geneticist in UMN Forest Resources Department, started the Minnesota Tree Improvement Cooperative in response to pressure by local industries and forestry units who wanted access to genetically improved seed for planting.

**1981** – Bob Stine hired to run MTIC

**1993-1995** – Rick Klevorn collaborates with MTIC to complete his MS degree

**1995-1997** – Rick hired by MTIC

**1998** – Carrie Pike hired as Bob Stine's assistant

**1998** – Jim Warren hired to create the Access database and do GPS work

**1999** -- Bob leaves MTIC

**1999** – Carrie becomes Coordinator and Andy David becomes Director of MTIC

**2007** – Carrie begins PhD program

**2012-2013** – Carrie serves as interim Director of Cloquet Forestry Center (CFC) while still coordinating MTIC and working toward PhD

**2012-2013** – Julie Hendrickson hired to assist Carrie and Jim with MTIC field work, completes MS degree

**2014** – Carrie completes her PhD

**2015 (Aug)** – Carrie is again named interim Director of CFC

**2015 (Nov)** – Carrie leaves MTIC for Area Regeneration Specialist position with USFS in West Lafayette, IN

**2015 (Nov)** – Andy becomes interim Director of CFC

**2016 (Jan)** – Jim leaves MTIC for Biological Scientist position with USFS in West Lafayette, IN

**2017 (Mar)** – Julie hired as Tree Improvement Specialist

## Appendix 2 - Dues Authorization Notice

We, **Organization**, hereby join the Minnesota Tree Improvement Co-operative. Using the guidelines developed by the Advisory Committee to the Minnesota Tree Improvement Cooperative, our share of the **CurrentYr** budget is **\$Dues**. This payment is for the current year only (January through December) and no commitment for future membership is implied. Should we decide to continue membership in subsequent years, we understand that membership fees may be adjusted upward or downward in accordance with the needs of our organization for services, number of cooperative members, and the operational costs of the cooperative.

Membership fees are to be used to defer the costs of the technical services provided by a tree improvement specialist employed by the College of Food, Agricultural and Natural Resource Sciences, University of Minnesota, to our organization. These services will include, but not be limited to, the development of long-term and annual tree improvement plans, assistance in the implementation of these plans, and the coordination of our forest tree genetic improvement activities with those of other cooperators.

It is understood that our membership fees will be commingled with those of other members and we will receive an account of the cooperative expenditures in January of **NextYr**. This report will not detail the expenditures of our membership fee per se. It will report the expenditures for all of the Cooperative's tree improvement activities.

We authorize the expenditure of our membership fee in the following areas: a) salary and fringe benefits, b) travel (consistent with University of Minnesota regulations), c) supplies and equipment, and d) computer processing. Funds will be allocated to these accounts in a manner which best serves the program of the Minnesota Tree Improvement Cooperative. The membership fee may not be used for any purposes other than the operation of the Minnesota Tree Improvement Cooperative. Unexpended funds at the end of **CurrentYr** will be retained by the University for use in continuing the Cooperative's tree improvement activities. Should the Minnesota Tree Improvement Cooperative become inactive, unexpended funds will be returned to member organizations using past contributions as a basis for prorating.

The technical contact for our organization with the cooperative program will be:

\_\_\_\_\_ (Name and Title)  
 \_\_\_\_\_ (Street Address)  
 \_\_\_\_\_ (City, State, Zip)  
 \_\_\_\_\_ (Phone)

This individual will represent our organization as a member of the Advisory Committee to the Minnesota Tree Improvement Cooperative and receive copies of technical correspondence, notices and reports issued by the Tree Improvement Specialist which have direct relationship to our organization's program or general operation of the Tree Improvement Cooperative.

Organization:

Signed: \_\_\_\_\_ Date: \_\_\_\_\_

I understand that payment is expected within 30 days following receipt of invoice sent under separate cover.

## Appendix 3 - Glossary

### **1<sup>st</sup> generation orchard**

An orchard that usually consists of phenotypically selected trees from natural stands

### **1½ generation orchard**

A 1<sup>st</sup> generation orchard becomes a 1½ generation orchard after it has been rogued of lesser individuals identified as a result of progeny tests

### **2<sup>nd</sup> generation orchard**

Initial selected trees (the 1<sup>st</sup> generation) were intermated to produce offspring (2<sup>nd</sup> generation) and individuals are selected from those offspring which are then planted into a new orchard

### **Clonal seed orchard**

An orchard that was established by propagating selected trees by grafting

### **Comparison trial**

Compares growth of different bulked seed sources. Seed from different sources (or orchards) are planted at multiple sites and include a woods run source as a control to test whether the seed orchard seed is better than an average wild source

### **Progeny test**

A field trial to estimate the genetic worth of parent trees based on the performance of their offspring

### **Rogue**

To remove inferior genotypes (i.e. cut out whole trees) from an orchard based on the results of a progeny test

### **Seedling seed orchard**

Orchard was established by planting seeds from selected trees. May be rogued later to remove the poorest trees, leaving the best trees from the best families for seed production

### **Seed orchard**

A collection of selected clones or families established in one physical location and then managed to produce genetically improved seed for operational reforestation

### **Seed production area**

A natural stand or plantation that is thinned by removing poorer phenotypes; the good trees are left to intermate and produce seed that can be collected for operational forestation

**Tree improvement**

Involves the application of forest genetic principles along with good silviculture to produce high yielding, healthy and sustainable forests by developing genetically improved seedlings in an economically efficient manner by maximizing genetic gain per unit time at the lowest possible cost

**Glossary references:**

White, Timothy L., W. Thomas Adams, and David B. Neale, eds. *Forest genetics*. Cabi, 2007.

Williams, Claire G. "Tree Improvement." *Forests and Forestry in the Americas*, Society of American Foresters, 22 Aug. 2007, [www.encyclopediaofforestry.org/index.php/Tree\\_Improvement](http://www.encyclopediaofforestry.org/index.php/Tree_Improvement). Accessed 24 Apr. 2017.

Zobel, Bruce, and John Talbert. *Applied forest tree improvement*. John Wiley & Sons, 1984.

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## Advisory Committee 2017

### Full Members

Beltrami County	DJ Bakken, Dick Moore
Cass County	Erik Lindquist
Crow Wing County	Bryan Pike
Iron Range Resources and Rehabilitation Board (IRRRB)	Dan Jordan
Koochiching County	Danae Schafer, Tom Toratti
Minnesota DNR - Forestry	Deb Pitt, Paul Dubuque
Red Lake Nation	Tony Arola, Jeff Fossen
St. Louis County	Rob Benson, Mark Pannkuk
Univ. of Minnesota Dept. of Forest Resources	Mike Kilgore, Andy David
UPM-Blandin	Greg Duwe

### Supporting Members

Bureau of Indian Affairs	Kristen Lease, Eric Oliphant
Carlton County	Greg Bernu, Mark Westphal
Clearwater County	Bruce Cox
Hedstrom Lumber Co.	Howard Hedstrom
Hubbard County	Allen Lysdahl
Lake County	Emily Sousa, Bill Nixon, Nate Eide

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This publication/material can be made available in alternative formats for people with disabilities. Direct requests to Julie Hendrickson, 175 University Rd, Cloquet Forestry Center, Cloquet, MN 55720, (218) 726-6406, email: [hendr065@umn.edu](mailto:hendr065@umn.edu)